2016 Northwest Fisheries Science Center YEAR IN REVIEW

164 papers published

58 interns mentored by our scientists

10 stock assessments planned for 2017

121 days at sea aboard NOAA Ship Bell M. Shimada and **300** days at sea aboard charter vessels

Over **215** days spent on the water in Puget Sound and **673** days in the Columbia River

Collected samples from over **900** marine mammals in Alaska to assess health risks from harmful algal blooms

Detected **81** contaminants in wastewater flowing into Puget Sound

Collected acoustic data along **4,000** nautical miles for Pacific hake survey

40 samples of **6** harmful algal species were analyzed remotely by a robotic biosensor off the Washington coast

2 science program reviews for Ecosystem Science and Aquaculture

1 NOAA Administrator's Award for our efforts during the historic West Coast harmful algal bloom in 2015

1 NOAA Distinguished Career Award for Dr. Bill Peterson's research on the impacts of climate variability on ocean conditions and productivity

Produced **50,000** sablefish fingerlings in pilot aquaculture project

Recycled **2,000** pounds of batteries and **6,500** pounds of electronics to reduce our landfill waste

HIGHLIGHTED ACCOMPLISHMENTS FROM 2016

PROTECTED SPECIES

Revealed widespread health risk in Alaskan marine mammal species due to harmful algal toxins

Scientists found toxins from harmful algae in Alaskan marine food webs, in high enough concentrations to be detected in 13 species of marine mammals from Southeast Alaska to the Arctic Ocean. The study, coordinated by a coastwide algal toxin monitoring network that includes the Northwest and Southwest Fisheries Science Centers, collected samples from more than 900 Alaskan marine mammals from 2004 to 2013. The findings document that the areas along the Pacific Coast where harmful algal blooms are known to occur have greatly expanded. In addition, algal toxins are now present in Arctic ecosystems, with the potential to affect most marine mammal species in U.S. waters farther north than expected. The microalgae that produce these toxins are likely to occur more frequently as oceans warm and the loss of sea ice increases light availability, so these toxins will pose a rising health risk to the marine mammals of the Subarctic and Arctic ecosystems.

Discovered pharmaceuticals and personal care chemicals in Puget Sound wastewater and Chinook salmon

Wastewater plant effluent entering Puget Sound was found to have some of the nation's highest concentrations of pharmaceuticals and personal care compounds. Working with the University of Washington, scientists tested for 150 of these compounds and detected 81, including the antidepressant Prozac, the diabetes medication metformin, antibacterial compounds from soap, and industrial chemicals. The study also found 42 of the compounds in the tissues of juvenile Chinook salmon and Pacific staghorn sculpin, fish native to Puget Sound. Some of the compounds were present in fish tissues at levels that may be high enough to adversely affect growth, reproduction, or behavior.

Provided the science to support delisting of canary rockfish

Center scientists completed sampling and genetic analyses of three species of ESA-listed Puget Sound rockfish (bocaccio, canary rockfish, and yelloweye rockfish) to support delisting of canary rockfish in this Distinct Population Segment, and revision of the DPS boundaries for yelloweye rockfish. The analysis was based on a comprehensive genomics analysis of a number of new and old samples collected around the region. The recently completed 5-year review summarized these conclusions, which have been forwarded to General Counsel for review.

Studied ocean conditions to forecast salmon returns

Since 1996, the Center has been monitoring the physical and biological ocean environment off the Washington and Oregon coasts, its interaction with the California Current, and how changing ocean conditions affect salmon originating from the Columbia River during their first months at sea. Using a suite of ocean indicators we developed, scientists can forecast the relative abundance of adult Chinook and coho salmon up to two years in advance. In 2015 and 2016, our indicators captured poor ocean conditions, primarily due to the effects of "the Blob" (a widespread area of warmer-than-usual ocean water off the West Coast) and a record-setting El Niño. Scientists are forecasting very poor returns of adult salmon to the Columbia River in the near future.

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HIGHLIGHTED ACCOMPLISHMENTS FROM 2016 (cont.)

SUSTAINABLE FISHERIES

Discovered that ocean acidification puts Dungeness crab at risk

Ocean acidification occurs as the ocean absorbs carbon dioxide put into the atmosphere by the combustion of fossil fuels. Average ocean surface pH off the West Coast is expected to drop to about 7.8 (i.e., become more acidic) by 2050, and could drop more during coastal upwelling periods. This ocean acidification may slow the development and reduce the survival of the larval stages of Dungeness crab—a key component of the Northwest marine ecosystem and the largest fishery by revenue in Washington and Oregon ($80M and $48M, respectively, in 2014), and the second-most-valuable in California ($67M in 2014). The fishery was recently closed in some areas because of a harmful algal bloom.

Deployed first survey of Pacific hake during winter

Center scientists conducted the first winter survey of Pacific hake off the coasts of Oregon and California. Before this survey, the most recent observations of Pacific hake during winter occurred 25 years ago. The 2016 survey supports an evaluation of the feasibility of a future winter biomass survey for Pacific hake and increases understanding of Pacific hake's biology in the California Current Ecosystem during the winter. The survey collected acoustic data along more than 4,000 nautical miles of transect and, in spite of the weather, completed 75 CTD casts, 32 midwater trawls, 25 zooplankton vertical net tows, and supported the collection of harmful algal bloom samples across the survey area. These data give us a modern look at Pacific hake distribution and biology (sex ratios, maturity, age, genetics, stomach contents, length, and weight) against which historical observations and hypotheses will be compared.

Released repository of fisheries survey data to public

Scientists launched the Fisheries Resource Analysis and Monitoring Data Warehouse, a centralized repository for public access to groundfish fisheries and monitoring data. In the past, users were required to submit written requests and wait weeks to months before being sent copies of our data. Now, the system allows direct access to data from our West Coast Groundfish Bottom Trawl Survey, Southern California Hook and Line Survey, Hake Acoustics Survey, Marine Habitat Program, and the West Coast Groundfish Observer Program.

Implemented first national prioritization for stock assessments

In 2016, NOAA Fisheries released the blueprint for a national initiative to improve the processes by which agency-managed species are selected for stock assessment. The Center led the first implementation of this new approach, in support of the Pacific Fishery Management Council's selection of West Coast groundfish species to be assessed in 2017. Scientists assembled data from commercial, recreational, and tribal fisheries, along with prior assessment and management information. Following a highly interactive process, the Council adopted the set of species and assessment types recommended by NOAA Fisheries, with concurrence of the advisory bodies.

Tested design of marine mammal excluder devices

As part of our goal to reduce bycatch during research or stock assessment surveys, Center scientists continued working on a cooperative study with the Southwest Fisheries Science Center to measure the effects of mammal excluder devices (MEDs) in the California Current. Since 2011, we have been testing a rigid-grate MED on trawl fishing for juvenile salmon and other upper-pelagic species during selected surveys. We compared the catch of 11 taxa using a pelagic rope trawl with the MED in two orientations (angled upward and angled downward) versus no MED. Salmon bycatch was reduced regardless of orientation; however, the orientation had a mixed effect on other species. Video observations helped to explain performance differences and may help improve MED design.

Released Regional Action Plan for the U.S. West Coast

The Northwest and Southwest Fisheries Science Centers published the Western Regional Action Plan (WRAP), which outlines present and prioritizes future efforts to increase the production, delivery, and use of the climate-related information required to fulfill NOAA Fisheries' mission. As the West Coast component of the NOAA Fisheries Climate Science Strategy, the WRAP focuses on assessing climate impacts on fishery resources through modeling and research supporting multisector ecosystem-based management. The WRAP will help coastal communities, commercial and recreational fishermen, and others who depend on the California Current ecosystem to respond and adapt.

HABITAT

Large-scale monitoring effort revealed that Oregon beavers engineer better fish habitat

An ecological experiment employed beavers to restore streams in Central Oregon, and found that the affected streams produced nearly double the juvenile steelhead within only a few years. NWFSC scientists and partners on Oregon's Bridge Creek were the first to show that reengineering of streams by beavers can yield such pronounced improvements in fish populations. Over seven years, the scientists tagged 35,867 fish with tiny electronic tags to track their movements and survival. The fish density in Bridge Creek increased and juvenile steelhead survival jumped 52 percent compared to a control watershed, showing that, under the right conditions, beavers can restore the health of streams and their fish, faster and likely at lower cost than traditional river restoration that relies on expensive heavy equipment.

Used environmental DNA across different habitats to study marine genetic diversity

Scientists implemented several collaborative studies using environmental DNA (eDNA) to explore how well this sampling method works for describing marine diversity. In collaboration with the Ocean Exploration Trust, we collected seawater at depths from 600–2,000 m off the West Coast and successfully recovered coral DNA sufficient for species identification. Working with the Alaska Fisheries Science Center, we collected seawater near wild harbor porpoises and successfully recovered DNA sufficient for species identification. Together with the University of Washington, we also began a study to investigate the efficacy of eDNA methods for detecting the occurrence and abundance of coastal fish species in Puget Sound. Finally, in collaboration with the University of Washington and USGS, we collected eDNA from Lake Washington to detect the presence and distribution of non-native walleye.

SEAFOOD SAFETY

Deployed first robotic water sampler for real-time monitoring of harmful algal blooms

For the first time, Center scientists conducted spring and fall deployments of robotic Environmental Sample Processors (ESPs) on a moored observatory approximately 13 miles off the Washington coast. The ESPs were positioned to provide early warning of toxic harmful algal blooms. In total, over 40 samples were analyzed remotely and autonomously for 6 harmful algae species and the toxin domoic acid over a period of 12 weeks. ESP observations were made available to coastal managers and the public in near-real-time, supporting ecological forecasting efforts in the Pacific Northwest to make coastal communities more resilient to toxic bloom events.

AQUACULTURE

Produced commercial-scale sablefish fingerlings in technology transfer project

Scientists at the Center's Manchester Research Station produced 50,000 sablefish fingerlings in a pilot-scale aquaculture project focused on transferring research technologies developed by NOAA biologists to the commercial-scale production of fingerlings. The technologies developed so far can significantly streamline the production of sablefish from the egg to fingerling stages, including identifying the optimal temperature and feeding regimes. Moreover, we developed the techniques to produce sablefish neomales (XX males) that can be used to make all-female stocks, and are currently producing approximately 10,000 all-female fingerlings per year to be reared to commercial harvest in net pens. Since sablefish females grow significantly faster than males, this is a significant commercial advantage for aquaculture.

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